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Assessing the status of amphibian breeding sites in Italy: a national survey

SOCIETAS HERPETOLOGICA ITALICA*

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Abstract. The ecological status of 203 amphibian aquatic breeding sites, selected from the national database of the *Societas Herpetologica Italica* (SHI), was surveyed in the period 2008-2009 to assess their ecological status. Sites were randomly extracted, after stratification by the three biogeographical regions present in Italy, besides Sardinia and Sicily. The field surveys, conducted by professionals, amateurs and volunteers, showed that since 1979 about 11% of the sites were destroyed or no more suitable for the reproduction of amphibians that bred in the same site in the past. The percentage of destroyed or altered sites was 8%, both in the Mediterranean and Alpine biogeographical regions, and 15% in the Continental one. However, there were no statistical significant differences among the regions, suggesting that the rate of amphibian site loss was similar in different parts of Italy. This nation-wide monitoring project demonstrated that in Italy, during the last thirty years, a relevant proportion of amphibian breeding habitats has been destroyed or altered. The main cause of site alteration were land reclamation and water extraction.

Keywords. Amphibian breeding sites, conservation, freshwater habitat loss, Italian amphibian survey, scientific monitoring, volunteers.

INTRODUCTION

Amphibians are the vertebrate class more at risk of extinction, and nearly one-third of the living species are currently considered threatened (Stuart et al., 2004). In fact, amphibian populations are declining in different parts of the planet, especially in mountain ecosystems in Central and South America, at high elevations in Western United States, and in South-eastern Australia (e.g. Alford and Richards, 1999; Houlahan et al., 2000; Lannoo, 2005). The causes of these declines are still under investigation and natural and anthropogenic factors such as habitat modifications, infectious diseases, introduction of exotic spe-

cies, toxic chemicals, increase in UV-B irradiation, and global climatic change have been considered (e.g., Beebee and Griffiths, 2005; Lannoo, 2005).

To date there are no quantitative nation-wide data on the status of amphibian species in Italy, although there have been general evaluations based on their overall distribution and natural history (Andreone and Luiselli, 2000, 2001; Sindaco, 2000, 2006).

Therefore in 2008 the *Societas Herpetologica Italica* (SHI), promoted a national monitoring project to assess the status of aquatic breeding sites of Italian amphibians. This project was based on the SHI database, containing more than 15,000 amphibian records that were collected by hundreds of professional herpetologists and volunteers, in addition to historical and museum data. These records were used to produce the Atlas of Italian amphibians and reptiles (Sindaco et al., 2006), and the national data base CKmap (S.H.I. in Ruffo and Stock, 2005). Each record of the SHI database is referred to a 10 × 10 km UTM grid square, administrative region, province, municipality, precise locality (if available) and type of record (bibliographic, museum specimen or unpublished observation).

The SHI monitoring project aimed to produce a national assessment based on field surveys carried out over a short time period, as already conducted in Switzerland for both amphibians (Schmidt and Zumbach, 2005) and reptiles (Monney and Meyer, 2005). In this pilot project however, only aquatic amphibian species were taken into consideration, since freshwater breeding sites are usually easy to recognize and to locate in the field, in particular by amateur herpetologists and volunteers.

MATERIAL AND METHODS

Survey design

This study was planned by a national coordination committee that acted on behalf of the SHI. Thus, site selection was centralized to reduce the possibility of “choosing” well-known or easy-to-find amphibian sites. The random selected sites were listed by administrative regions and assigned to a regional coordinator committee, formed by one or more SHI associates. The regional coordinator(s) performed the surveys personally or in collaboration with local herpetologists or volunteers. Thus, the management and the structure of project was similar to the one of the Italian herpetological atlas (Sindaco et al., 2006).

All the sites stored in the SHI database were sorted by date and only those dating after 1979 were retained for monitoring. The sites were selected by the past occurrence of selected species. Then, the sites were stratified by the three biogeographical regions represented in Italy: Alpine, Continental and Mediterranean (Condé et al., 2002). A total of 340 sites were randomly extracted from these strata in relation to their surface (see Table 1), assuring however that at least 20 sites each were from the two main islands (Sardinia and Sicily), characterized by peculiar amphibian faunas. Thereafter the monitoring project was divided in two phases. In the first, amphibian breeding sites had to be visited to assess their current ecological status, and in particular if they were still suitable for amphibian reproduction. In the second, those sites found suitable should have been sampled intensively for two consecutive breeding seasons (i.e., years), to obtain presence/absence data of amphibian species with three surveys per breeding season (Schmidt and Zumbach, 2005).

Field sampling protocol

All participants to the monitoring project had to compile a field data sheet. In the first part of the sheet the operator had to clearly state if the exact location of the amphibian breeding site was found. If not, she or he had to stop the survey and ask the national coordinators for a substitute site. In this case, a new site with the same species located within the same biogeographic region was randomly extracted the stratified database. If the original site was localised with a relative good confidence, then the compiler had to give precise UTM WGS 84 coordinates, habitat description, and a subjective but convincing judgement on the ecological status of the site in particular about the suitability for the reproduction of amphibian species previously reported. Moreover, she or he had to describe the reasons that caused the observed alteration or destruction of the site, choosing from a list of threats ranging from natural vegetation succession, introduction of alien species up to the complete destruction caused by man.

RESULTS

During the period 2008-2009, only 203 (60%) out of the selected 340 sites were surveyed. Localisation of the sites surveyed during this study shows that their distribution covered the entire Italian peninsula, comprising the Alps, Sardinia and Sicily (Fig. 1).

According to local coordinators, missing sites could not be surveyed mainly at cause of lack of funds to cover travel expenses and shortage of trained volunteers. These logistic problems hindered the survey of many high-altitude and poorly accessible sites in the Alps and in the Apennines (Fig. 1, Table 1). Due to the difficulties to complete the first phase of the project, the second one, which demanded a much more intensive field effort by the operators, was stopped by the national coordination committee in accordance with the regional coordinators.

Despite the anticipated end of the program, the data collected underline a negative picture of the present conservation status of amphibians in Italy. Indeed, the percentage of destroyed sites was 8% both in the Alpine and Mediterranean biogeographic region, while it was 15% in the Continental one. However, there were no significant differences in the distribution of destroyed sites among the regions according to a chi-square analysis ($\chi^2 = 2.802$; $df = 2$, $P = 0.246$). The overall percentage of destroyed amphibian breeding sites in Italy in the last 30 years was 11%.

The main causes of the destruction or alteration of the breeding sites are resumed in Table 2. It is clear that land reclamation, construction and drainage were the main causes of the loss of amphibian breeding sites.

DISCUSSION

The present study represents the first scientific assessment of the ecological status of amphibian breeding sites in Italy. One of the main conclusions concerns the efficiency of an Italian national survey exclusively based on volunteers and not sustained by any kind of public funding. The herpetological Association SHI has not been able to ensure any kind



Fig. 1. Distribution of the 203 amphibian breeding sites assessed for their ecological status in 2008-2009, in Italy.

Table 1. Number of randomly selected sites per biogeographical region, number of surveyed and destroyed/unsuitable amphibian sites.

Biogeographical region	Sites extracted	Sites surveyed (% of extracted)	Site destroyed (% of surveyed)
Alpine	40	12 (30%)	1 (8 %)
Continental	90	82 (91%)	13 (15%)
Mediterranean	210	109 (52%)	9 (8%)
Total	340	203 (60%)	23 (11%)

of reimbursement to its associates or to volunteers involved in the monitoring programme. This caused the premature interruption of the programme, as only 60% of the selected sites were assessed. Therefore, the second phase of the programme, which requested the

Table 2. Causes of destruction/alteration of amphibian breeding sites in Italy.

Cause of destruction/alteration	Number of sites (%)
Natural succession of vegetation	1 (4.3)
Land reclamation/water drainage or extraction	14 (60.9)
Water pollution	1 (4.3)
Site management (unsuitable for reproduction)	1 (4.3)
Site abandonment (artificial sites)	1 (4.3)
Introduction of alien species (crayfish, fish etc.)	2 (8.7)
Unknown	3 (13.1)
Total	23 (100.0)

monitoring of amphibian populations on a species-based protocol, never began. In other countries, where some kind of public coordination or funding is assured, as is the case of Switzerland (Schmidt and Zumbach, 2005) and the Netherlands (van der Meij et al., 2009), amphibian monitoring is successfully maintained over relatively long-periods by volunteers coordinated by scientific staff. Indeed, these kind of mixed programmes provide important insights on how to assure persistency and efficiency of monitoring environmental projects, providing scientific data concerning amphibian populations trends.

In any case, the present partial results confirm the general claim that amphibian aquatic habitats are disappearing and that amphibian populations are declining. Indeed for the first time, quantitative data on the rate and causes of alteration or modification of amphibian breeding sites in Italy have been provided.

The main cause of aquatic habitat destruction or alteration was by far the direct modification of their ecological status by man (i.e., drainage for land reclamation), while other indirect causes, such as introduction of invasive species, were also relevant. In addition to this latter phenomenon, already relatively well studied in Italy (Lillo et al., 2011; Gherardi et al., 1999), we have to consider also the possible spreading of infectious diseases, such as the chitrid fungus *Batrachochytridium dendrobatidis* (Weldon et al., 2004), that still have not yet been evaluated at the Italian-wide level. Moreover, we have to consider the great alteration and the fragmentation of terrestrial habitats (Berdini, 2009) that may also cause amphibian population widespread long-term declines. Unfortunately, the results of this study, limited to the assessment of aquatic habitats, does not allow any evaluation of these threats.

Moreover, this study was not conceived to assess or census newly-formed habitats suitable for amphibian reproduction. In fact, it is possible that in the last 30 years some new breeding sites were generated or restored by natural hydrological processes, such as river floods, or by the creation of artificial wetlands. However, in developed countries the dynamic processes of streams and rivers are usually highly limited by humans in order to provide new land for agriculture, urban development or infrastructures (Brierley, Fry-irs, 2005). Conversely, some recent amphibian conservation projects have been active (e.g., Bressi, 1996; Bressi et al., 2000; Lapini, 2007). These conservation projects surely increased the number of pond habitats for biodiversity and in particular for amphibians, at the local level. Therefore, the mean rate of disappearance of breeding sites estimated by the present study (11% in the last 30 year) is probably slightly overestimated.

Finally, the assessment of the conservation status of all the amphibian species listed in the European directive "Habitat and Species" 92/43/CEE is requested by article 17, and should be reported to the European Commission in 2012. However, to date there are no available nation-wide monitoring data on the trends of amphibian populations, and the present study clearly shows that in Italy a wide-scale monitoring is not feasible only through the exclusive use of volunteers, without an official engagement of regional and national environmental Authorities.

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